An Annual Cycle of Upper Ocean Salinity Captured by High-Resolution Glider Survey

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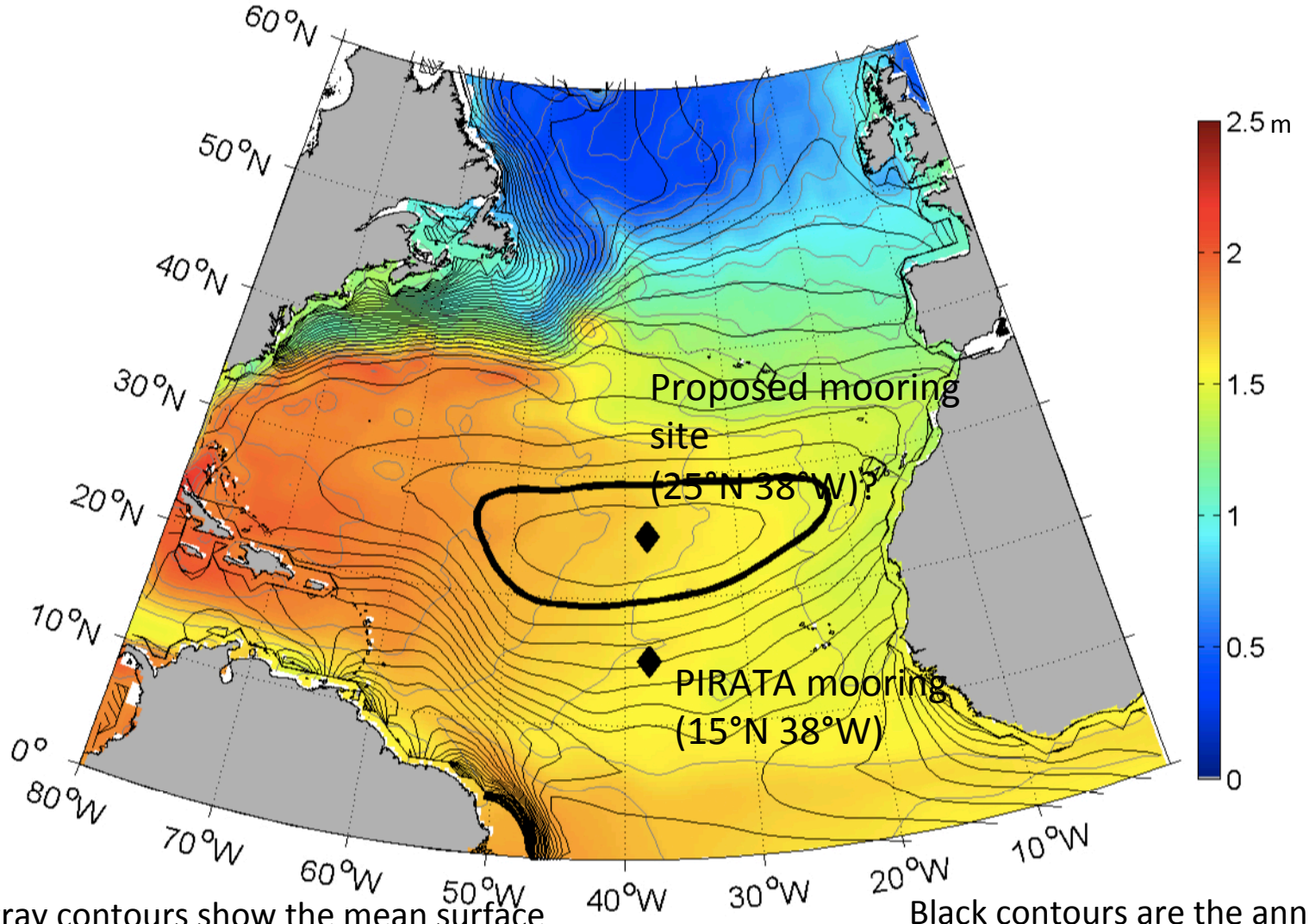
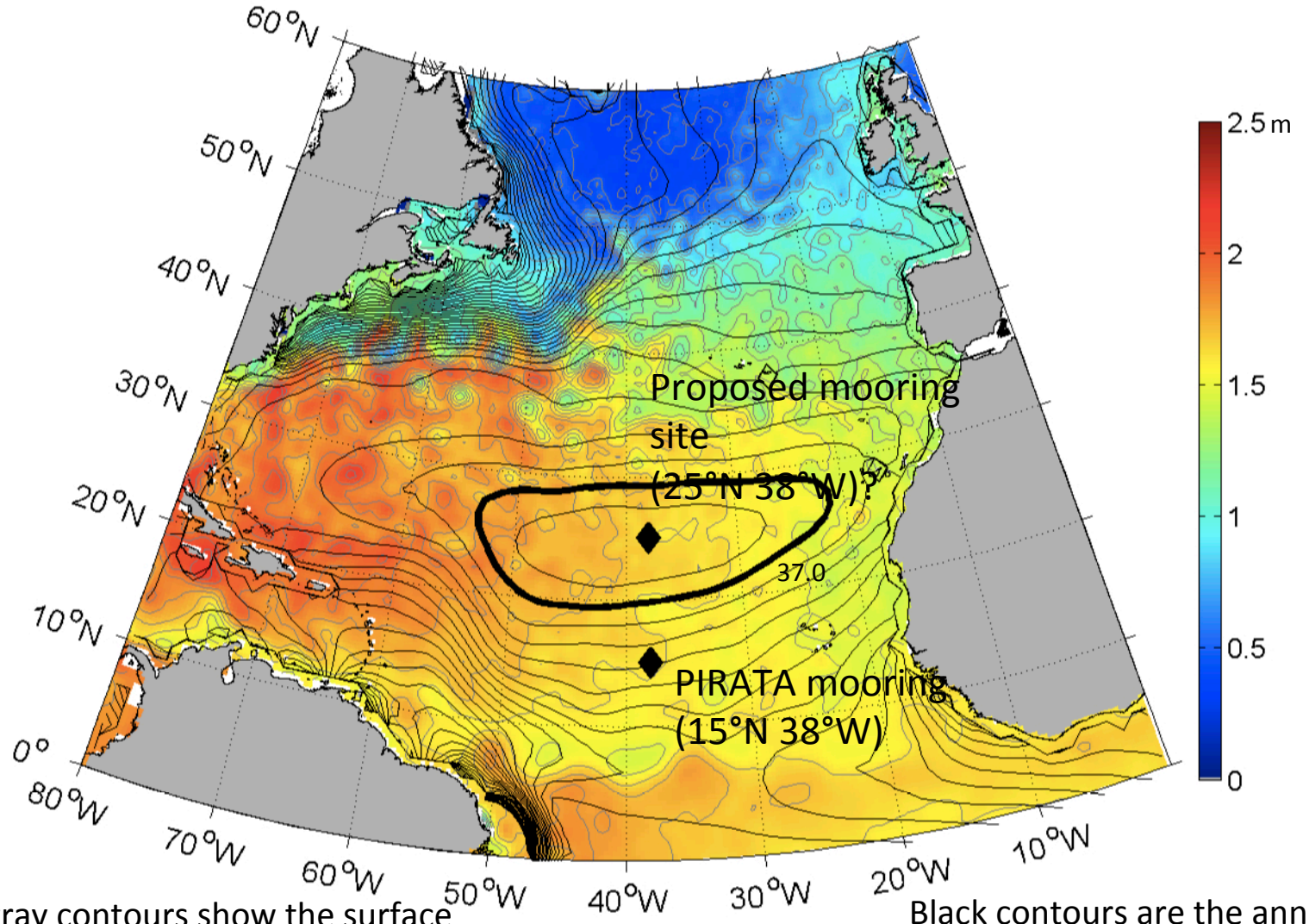
Salinity maximum & mesoscale field



Colors and gray contours show the mean surface absolute dynamical topography (0.1 m intervals) (RIO03 – Aviso)

Black contours are the annual SSS (0.2 intervals) from the World Ocean Database 2005.

Salinity maximum & mesoscale field



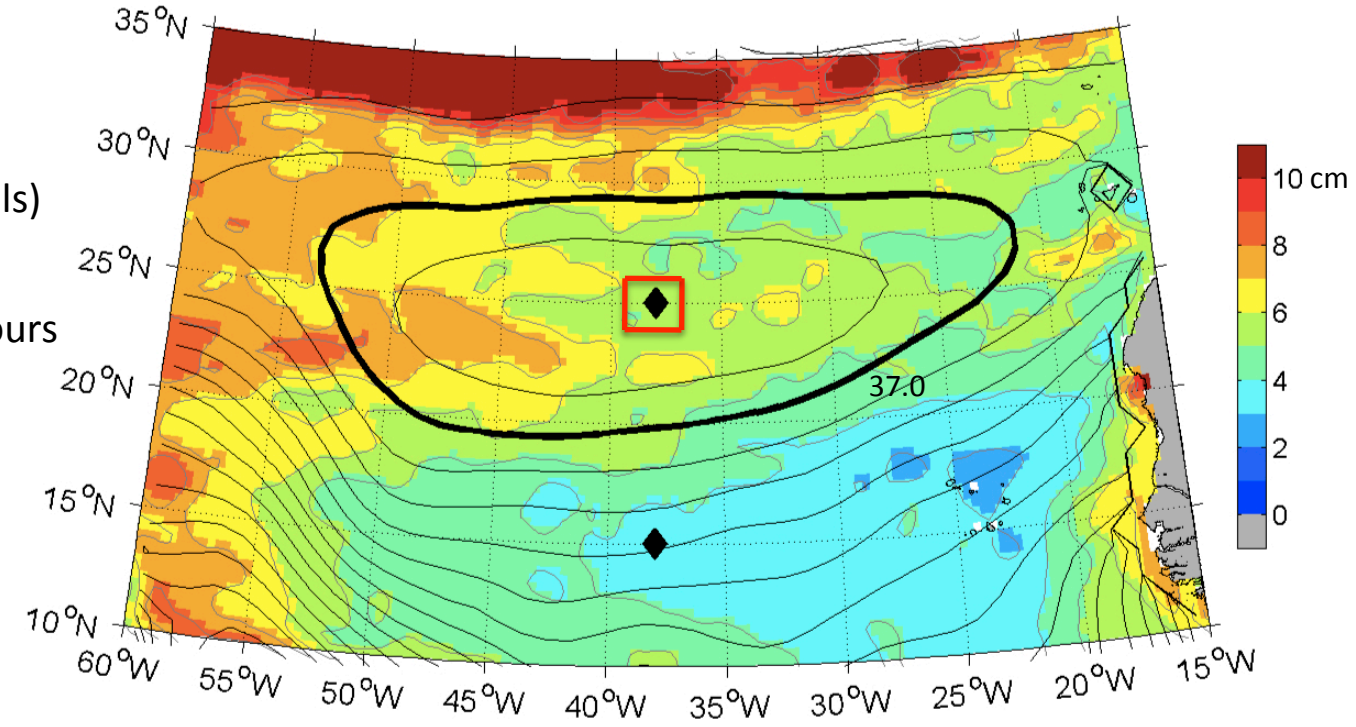
Colors and gray contours show the surface absolute dynamical topography (0.1 m intervals) on January 1st 2008 from satellite altimetry (AVISO)

Black contours are the annual SSS (0.2 intervals) from the World Ocean Database 2005.

Salinity maximum & mesoscale field

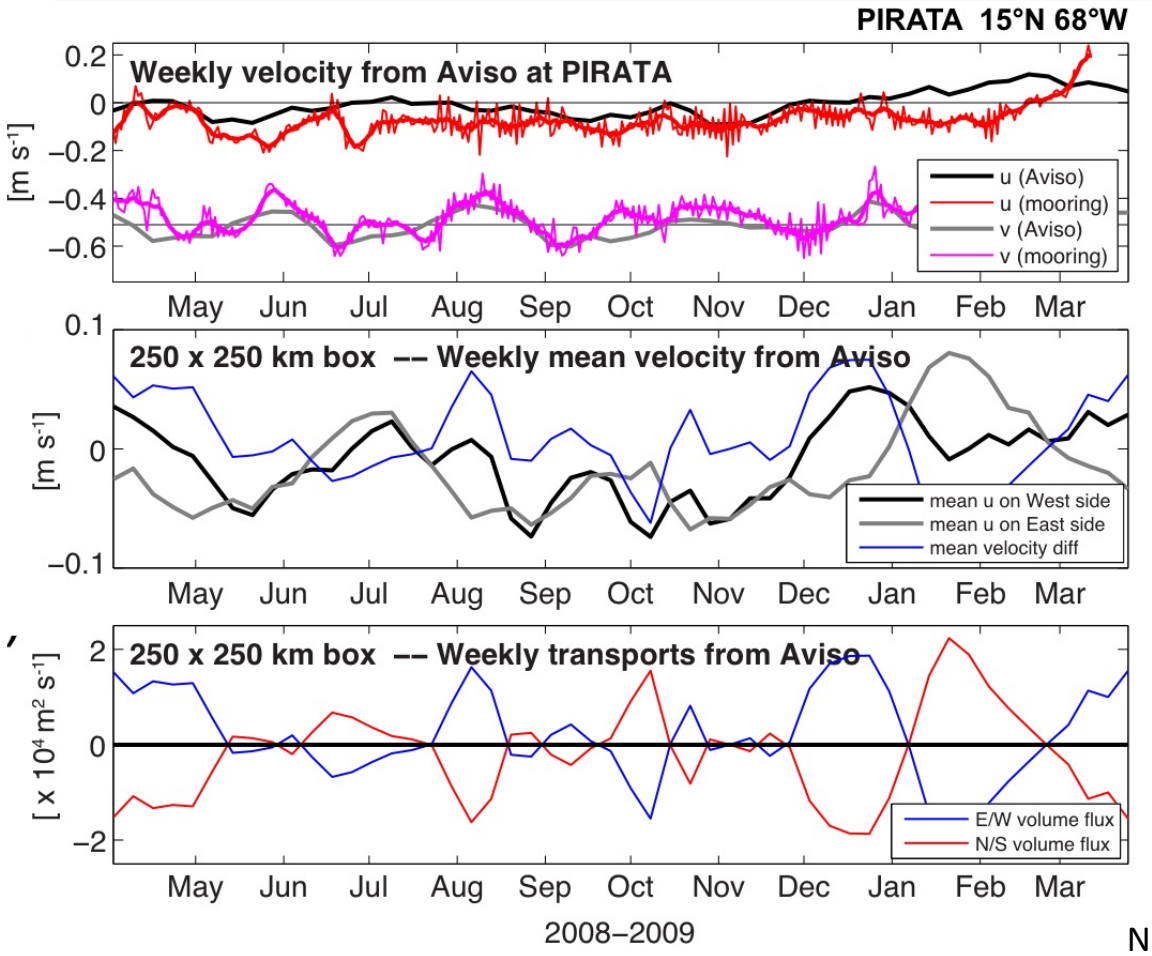
10-year rms SSH from altimetry (1 cm intervals)

Annual mean SSS contours (0.2 intervals)



Time and spatial scales

Budget in a 200 x 200 km box:
Measurements resolving scales of 14-day and 50 km.



Measured and geostrophic currents

Taking a 250 km box centered on the mooring...

Averaged currents in
Averaged current out
Difference (convergence)

Net transport from the East and West sides and South and North sides.

Note: Because the surface geostrophic field is non-divergent, the net volume transport is zero.

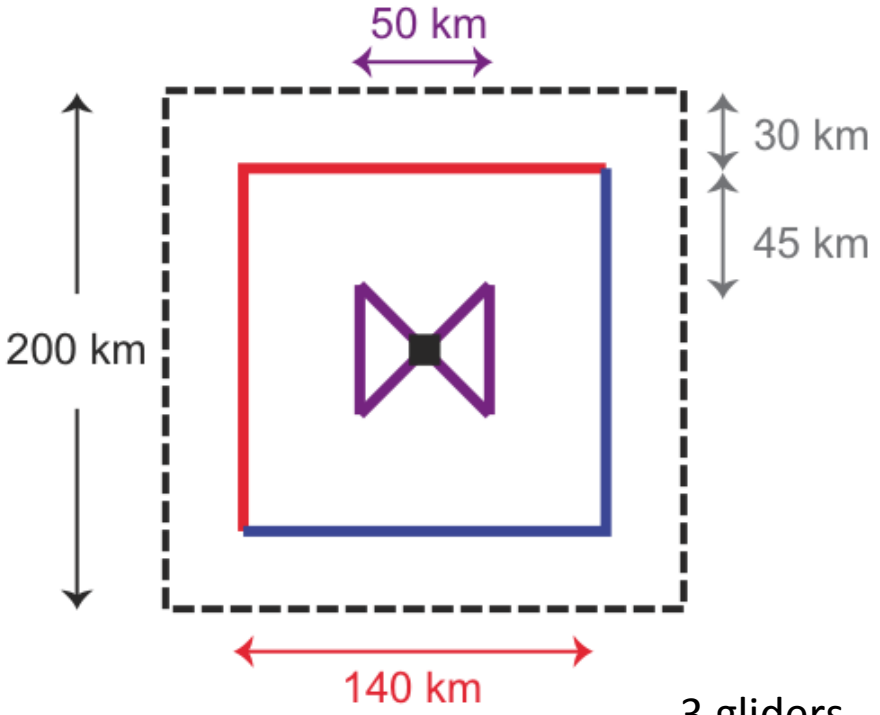
Seaglider Program Science Objectives

Over deployments lasting an **entire year:**

1) Resolve the S, T, ρ, and u in the upper 1000 m in 200 km by 200 km box centered on the mooring, over temporal scales of **14 days** and spatial scales of **50 km**.

2) Measure the rates of turbulent dissipation in the thermocline and at the base of the mixed layer.

3) Provide large-scale spatial context for the SPURS site.

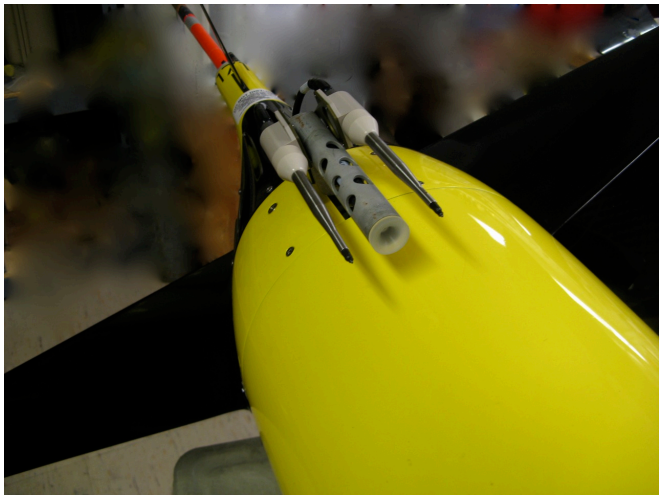


3 gliders.

Resolve **salt storage** and horizontal and vertical **advection** of salt, and quantify the diapycnal **mixing** of salt by small scale turbulence around the mooring,

Direct estimate of the main terms of the mixed layer and upper pycnocline (to 1000 m depth) salinity budget.

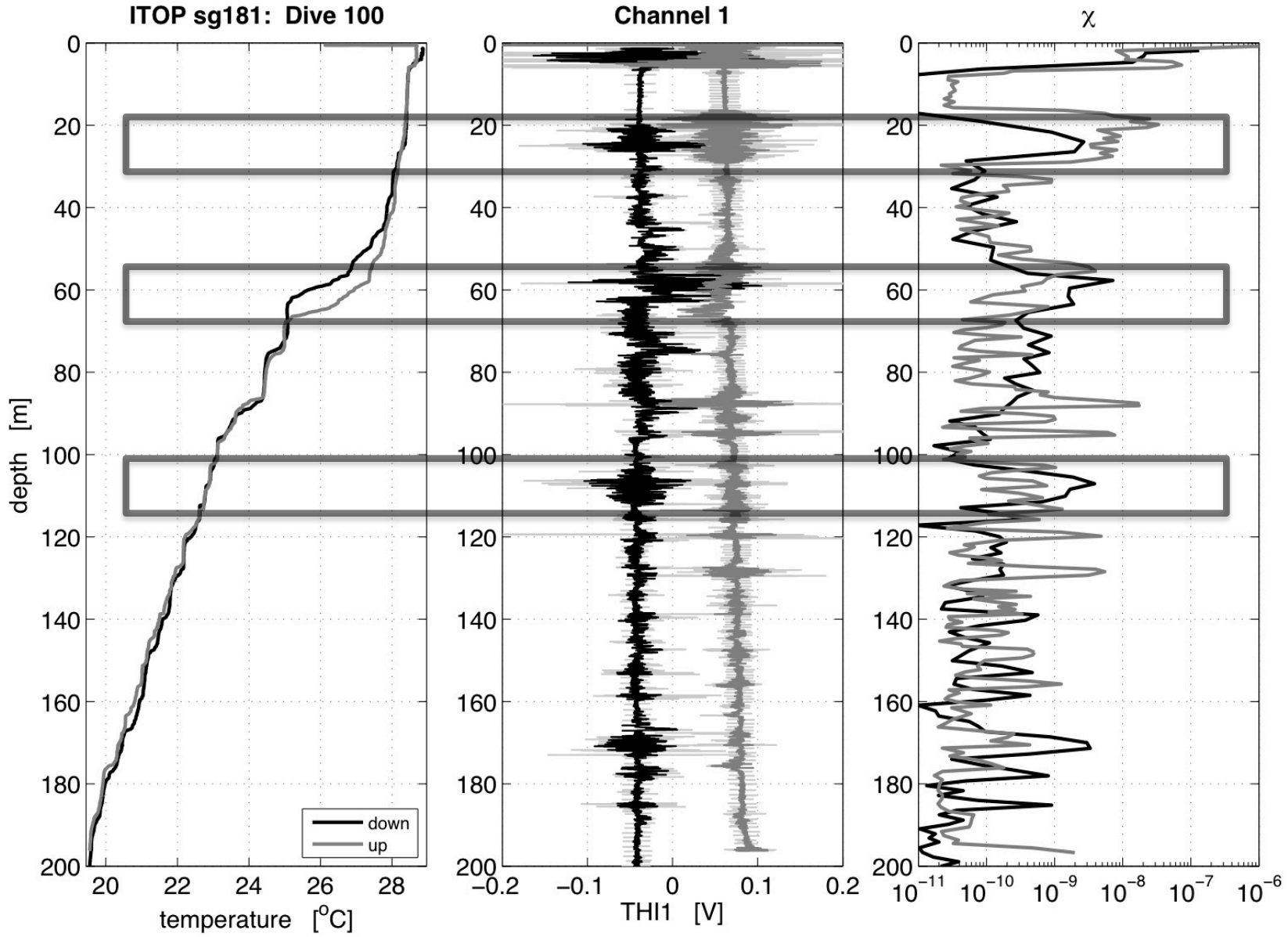
Micro-temperature Seaglider



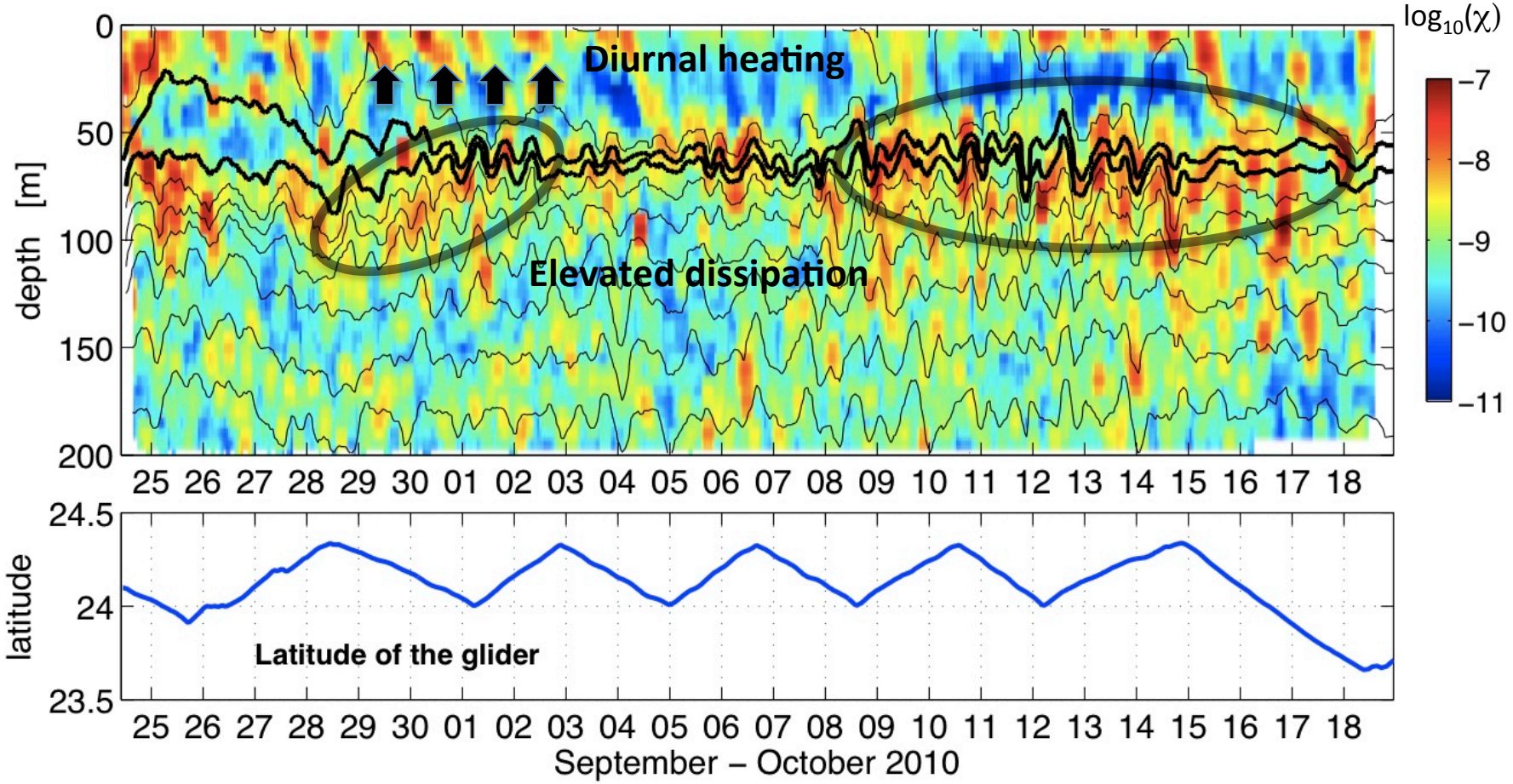
Measure small scale (cm) fluctuations of temperature: related to turbulence and dissipation of energy.

Deployed 3 gliders with Tmicro during ITOP, in September-October 2010 in the Western Pacific.

Typical χ profile in typhoon wake



Time series of χ in typhoon wake



SG181 in typhoon Fanapi cold wake

512 χ profiles from this glider alone!

χ recorded in the upper 200m during dive an climb, 256 profiles to 500m, every 2h

Logistics and Discussion Points

Operations

Deploy *3 gliders* around the flux mooring for an entire year.
Six-month missions (sensor payload limits endurance)

- Deploy during mooring deployment?
- Turn-around cruise (6-month mark), *during the process study*?
- Recover with the mooring?

Data distribution

Real time data available to all PIs (including real-time microstructure) .

Large-scale survey?

A long meridional line (1000km+) across the salinity gradient could be occupied with a Seaglider on a monthly time scale, resolving seasonal cycle and providing reference for other floats and drifters. *Need 2 more gliders.*

Ship needs

Can we do SPURS on an intermediate-class ship? **YES**

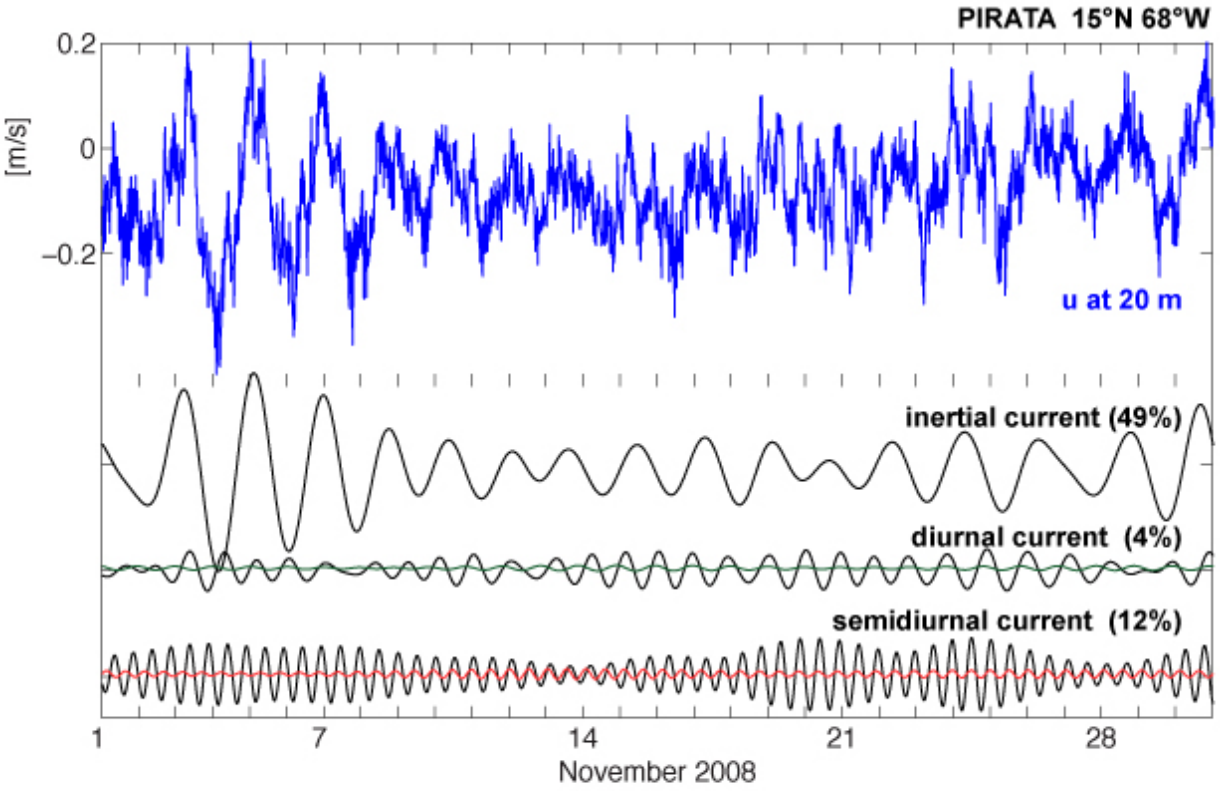
How many essential people are required for each group? **1**
How many other able-bodied help are needed (if other groups can provide help)? **1**
How many people can your group share to support other groups? **1**

How many dedicated days at sea does your group need, station and underway? **3**
Can some of that time be used by other groups concurrently? **YES**

What is the desirable interval between cruises? **6 months**
What is the maximum allowable interval between cruises? **6 months**

What are the best ports for ship loading? **No preference**
What are the best ports for staff loading/offloading? **Shortest cruise duration**
How much inner lab space is needed, dry, wet, office, other requirements? **One bench**
How much deck space is needed for vans and other storage? **None**
How much below-deck, hold space is needed for storage? **None**
What efforts should be made with respect to underway measurements:
CTD with SBE43 (and/or O2 titration) for cal. casts, ADCP.

Currents at the PIRATA site

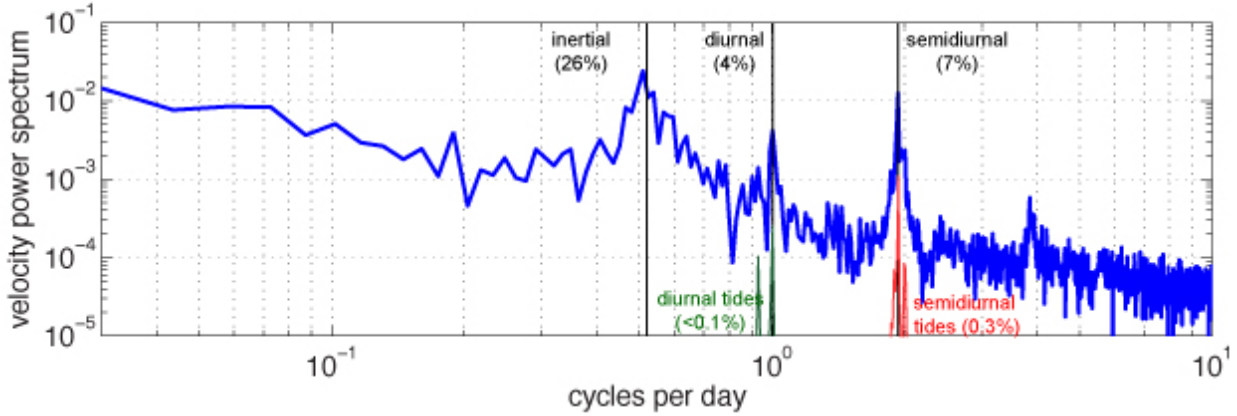


Measured eastward velocity (one month)

Inertial

Diurnal (and TPXO O1+K1)

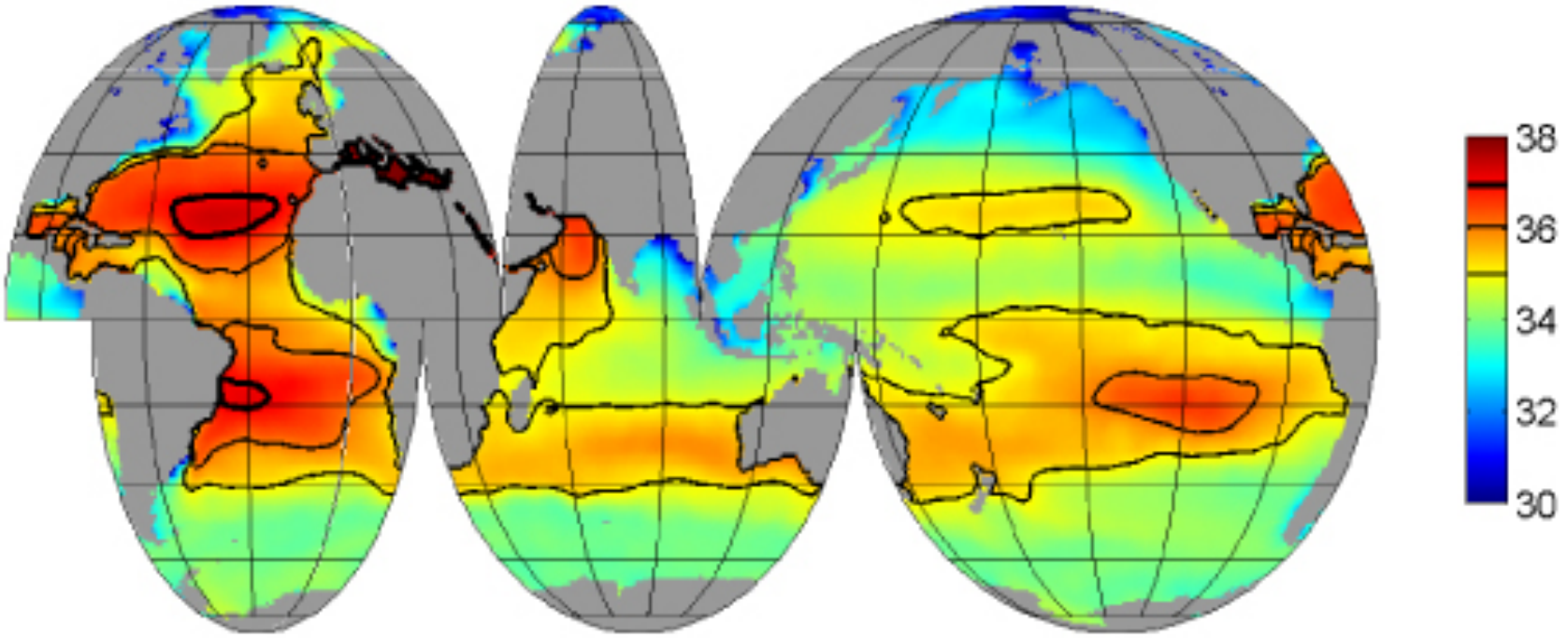
Semidiurnal (and TPXO M2+S2)



Velocity spectrum (one year)

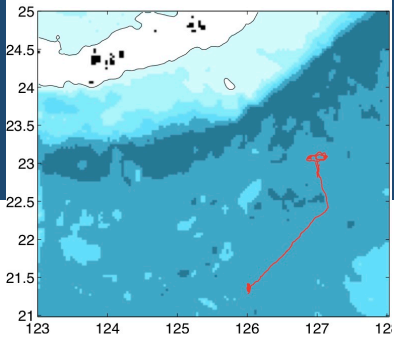
Large inertial motions, large baroclinic tides!

Global Sea Surface Salinity



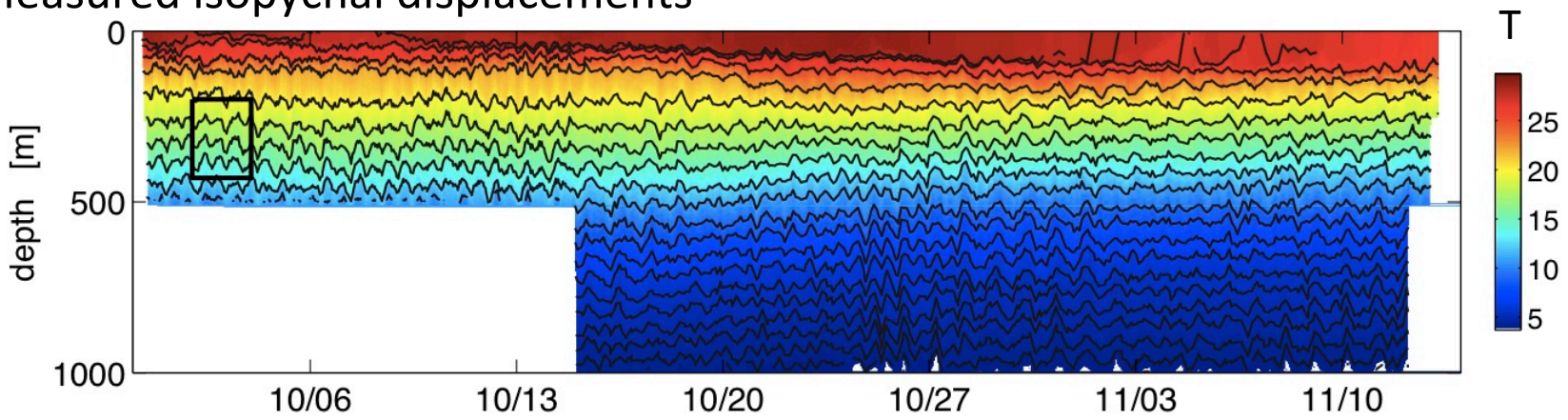
Time-mean sea surface salinity from the World Ocean Database 2005

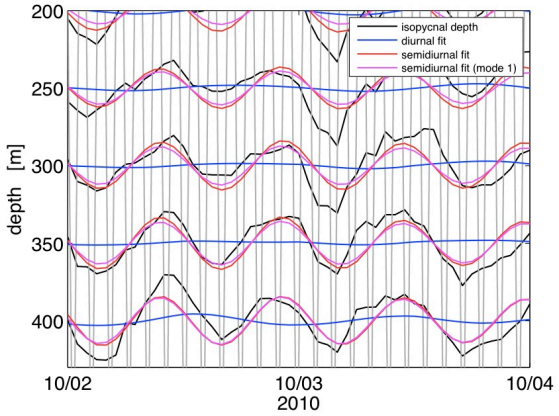
Gliders and internal waves



SG167

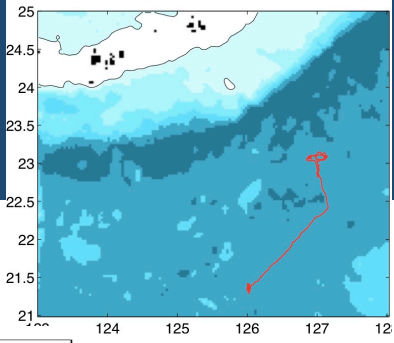
Measured isopycnal displacements





Fitting semidiurnal (12h) and diurnal (24h) and inertial (here 30h) waves to measured displacements.

Gliders and internal waves



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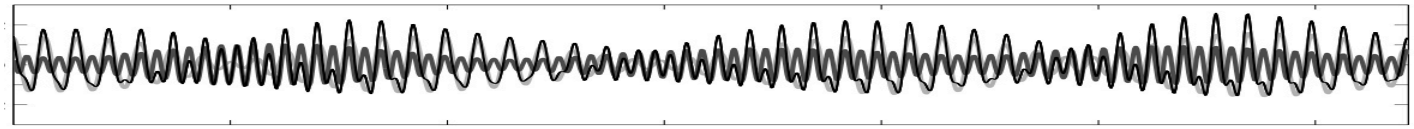
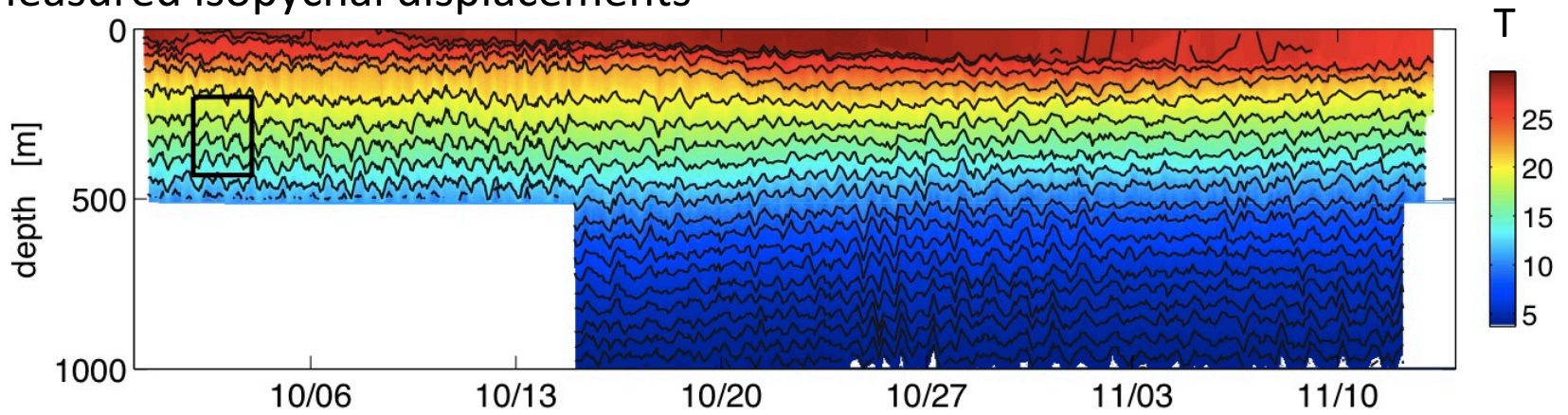
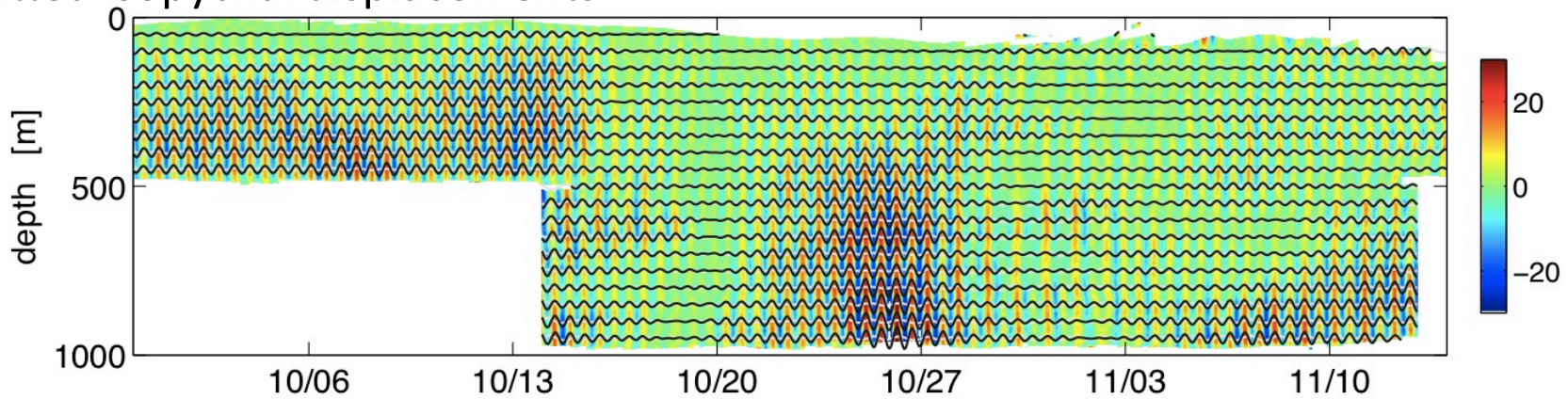
Barotropic tide in Luzon Strait



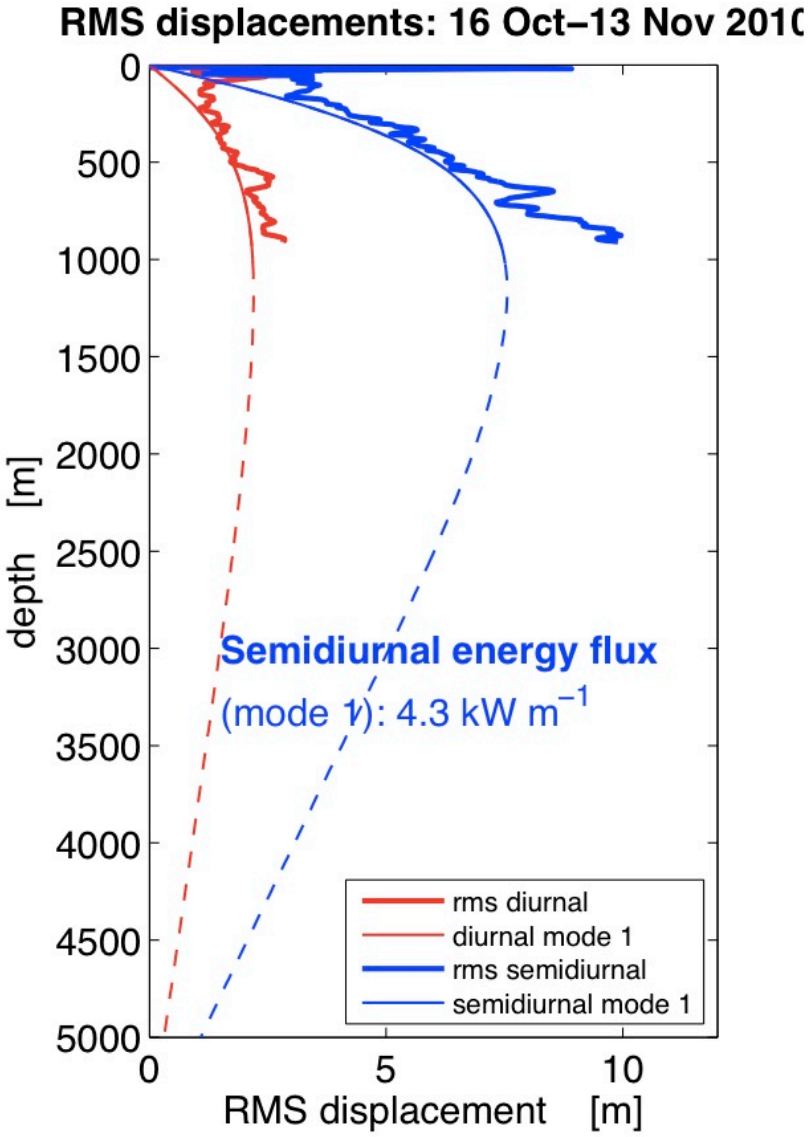
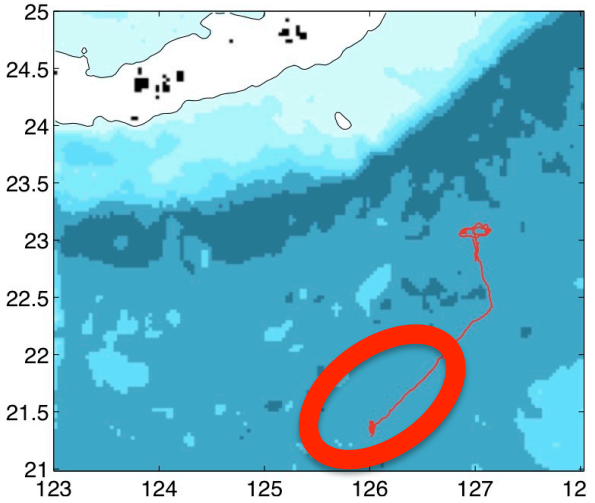
Measured isopycnal displacements



Fitted isopycnal displacements



Gliders and internal tides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